

ISO/TC 154 N0039

Date: 2016-02-16

ISO/WD 8601-2

ISO/TC 154/WG 5

Secretariat: SAC

Data elements and interchange formats — Information interchange - Representation of dates and times — Part 2: Extensions

Eléments de données et formats d'échange — Échange d'information - Représentation de la date et de l'heure — Partie 2: Extensions

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Document type: International Standard

Document subtype:

Document stage: (20) PreparatoryStage

Document language: E

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/154, *Processes, data elements and documents in commerce, industry and administration*.

This first edition of ISO 8601-2 extends ISO 8601-1:2016

ISO 8601 consists of the following part, under the generic title *Data elements and interchange formats — Information interchange - Representation of dates and times*:

- Part 1: Basic rules
- Part 2: Extensions

Introduction

To be developed during the Committee Stage

Data elements and interchange formats — Information interchange - Representation of dates and times — Part 2: Extensions

1 Scope

This International Standard is applicable whenever representation of dates in the Gregorian calendar, times in the 24-hour timekeeping system, extending ISO 8601-1:2016. It includes

- calendar dates expressed in terms of calendar year, calendar month and/or calendar day of the month;
- combination of date and time of day including local time based upon the 24 hour timekeeping system and the difference from Coordinated Universal Time;
- Uncertain or approximate dates, or dates with portions unspecified.
- time intervals ;
- Divisions of a year ;
- Sets and choices of calendar dates ;
- repeat rules for recurring time intervals.

This International Standard does not cover dates and times where words are used in the representation and dates and times where characters are not used in the representation.

This International Standard does not assign any particular meaning or interpretation to any data element that uses representations in accordance with this International Standard. Such meaning will be determined by the context of the application.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/WD 8601-1:2016, Data elements and interchange formats — Information interchange - Representation of dates and times — Part 1: Basic rules

ISO/IEC 14977:1996 Information technology — Syntactic metalanguage — Extended BNF

3 Terms and definitions

For the purposes of this document, the following terms and definitions.

3.1

uncertain

date whose source is considered dubious

3.2

approximate

date which is an estimate whose value is asserted to be possibly correct, and if not, close to correct

Note 1 to entry: Where 'close to correct' means "close enough, for the application".

3.3

unspecified

part of a date which is unstated, which could be because it has not (yet) been assigned (it might be assigned in the future), or because it is classified, or unknown, or for any other reason. The unspecified part may be the year, year and month, month, month and day, or year and day.

4 Date and Time Extensions

4.1 General

4.1.1 Extended format

For features described in this part of ISO 8601, Clause 4, only the extended format (YYYY-MM-DD) is used. Basic format (YYYYMMDD) is not to be used.

4.1.2 Levels

For the extension features, two levels are defined: level 1 and level 2. Each major subsection of section 4 covers a general feature; some functions covered by that feature are level 1 and some are level 2. These levels are defined for the purpose of profiles, which may refer to the levels when specifying conformance to the profile. Profiles are described in Annex B.

4.2 Uncertain and/or approximate date

The character '?' (question mark) is used to mean "uncertain". The character '~' (tilde) is used to mean "approximate". The character '%' (percent) is used to mean "both uncertain and approximate".

4.2.1 Level 1

For level 1, '?', '~', or '%' may only occur at the end of the date string, and it applies to the entire date.

Format: YYYY-MM-DD ?	Example: 1985-04-12?
Format: YYYY-MM-DD ~	Example: 1985-04-12~
Format: YYYY-MM-DD %	Example: 1985-04-12%

Representations with reduced accuracy

- a) Year and month
 - Format: YYYY-MM? Example: 2004-06?
 - Format: YYYY-MM ~ Example: 1985-04~
 - Format: YYYY-MM % Example: 1985-04%
- b) Year only
 - Format: YYYY? Example: 2004?
 - Format: YYYY~ Example: 1985~

YYYY%

Example: 1985%

4.2.2 Level 2

For level 2, the characters '?', '~', and '%' may be used to qualify a portion of the date (not necessarily the whole date).

- One of the three characters may occur immediately to the right of one of the date components, in which case it applies to that component as well as any components to the left.
For example if it occurs immediately to the right of the day, it applies to the day, month, and year (i.e. the entire date string). If it occurs to the right of the month, it applies to the month and year (but not the day). If it occurs to the right of the year, it applies to the year only.

Examples:

- 2004?-06-11
uncertain year; month, day known
- 2004-06~-11
year and month are both approximate; day known
- 2004-06%-11
year and month are both uncertain and approximate ; day known

- One of the three characters may occur immediately to the left of one of the date components, in which case it applies only to that component.

For example if it occurs immediately to the left of the day, it applies only to the day (and not to the month, or year). If it occurs to the left of the month, it applies only to the month (and not to the year or day). If it occurs to the left of the year, it applies only to the year (and not to the day or month)..

Examples:

- 2004-?06-11
uncertain month; year and day known
- 2004-~06-11
approximate month, year and day known
- 2004-%06-11
month uncertain and approximate, year and day known
- ?2004-06-?11
uncertain year and day, month known
- ?2004-06-~11
Year uncertain, month known, day approximate

- The above two features may be combined*

- 2004-06?-~11
Year and month uncertain (because '?' is to the right of month meaning that it applies to month as well as components to the left of month) and day approximate
- 2004?-06-~11
Same meaning as ?2004-06-~11 (earlier example): *Year uncertain, month known, day approximate.*

Guidelines

There are cases where more than one string has the same meaning.

For example:

- '2015-02?-31' has the same meaning as '?2015-?02-31'. In this case, the first form is preferred because there are less special characters.
- 2015?-02-31 has the same meaning as ?2015-02-31. In this case the second form is preferred, because it may simplify parsing.
- 2015-02?-31' has the same meaning as '2015-?02?-31'. In this case, the first form is preferred because the '?' in "?02" in the second form is redundant.

4. '2015-02-31?' has the same meaning as '2015-02~-31?' . In this case, the first form is preferred because it is simpler.

4.3 Unspecified

The character 'X' may be used as a replacement character, in place of a digit to indicate that the value of that digit is unspecified.

4.3.1 Level 1

The replacement character 'X' may be substituted for the right-most digits in the following cases:

- Year and month specified, day unspecified.
- Year specified, day and month unspecified.
- Entire date unspecified

Format: YYYY-MM-XX Example: 1985-04-XX
YYYY-XX-XX Example: 1985-XX-XX
XXXX-XX-XX Example: XXXX-XX-XX

Representations with reduced accuracy

For representations with reduced accuracy, 'X' may be used in the following cases:

- A year-month, with month unspecified.
- A year-month, with year and month unspecified.
- A year with one or two (rightmost) unspecified digits.
- A year, entire year unspecified.

Format: YYYY-XX Example: 2004-XX
XXXX-XX Example: XXXX-XX
YYYX Example: 209X
YYXX Example: 20XX
XXXX Example: XXXX

4.3.2 Level 2

For level 2 the character 'X' may be used as a replacement for any character in the string.

Examples

156X-12-25	December 25 sometime during the 1560s
15XX-12-25	December 25 sometime during the 1500s
15XX-12-XX	Some day in December in some year during the 1500s
1560-XX-25	The 25th day of some month in year 1560.
1560-X2	The month of either February or December of the year 1560.
1XXX-XX	Some month during the 1000s
1XXX-12	Some December during the 1000s
1XXX	Some year during the 1000s
1XX3	Some year ending in 3 during the 1000s

4.4 Before or after

A date may be qualified to indicate "before or on" or "on or after" the date.

4.4.1 Level 1

This feature is not used in level 1.

4.4.2 Level 2

For level 2, the dot notation “..” (two dots) may be used before a date to denote "before or on the date" or after a date to denote "on this date or after":

Examples

- ..1984 before or during the year 1984
- 1984.. during the year 1984 or later
- ..1984-04-04 before or on 4 April 1984

4.5 Enhanced time interval

An enhanced time interval extends the specification of time interval in Part 1 of this standard (start and end date separated by '/') by indicating that the start or end date is:

- Unknown.** Start or end date unknown. The character '*' (asterisk) may be used for the start or end date to indicate "unknown".
- Open Start or** date open. The start or end date may be left blank, either because there is none or for any other reason.

The following are allowed but should be used only with caution:

- */* start and end both unknown
- '/' start and end date both open
- '/* Start unknown, end open
- '/*'. Start open, end unknown

4.5.1 Level 1

format: YYYY-MM-DD/*	Example: 1985-04-12/*
*/YYYY-MM-DD	Example: */1985-04-12
YYYY-MM-DD/	Example: 1985-04-12/
/YYYY-MM-DD	Example: /1985-04-12

In addition a modifier may appear at the end of the date to indicate "uncertain" and/or "approximate" as described in 4.2.

Examples:

- 1984-01-02~/2004-06-04
beginning approximately 1984-01-02 and ending 2004-06-04
- 1984-01-02~/
beginning approximately 1984-01-02; no end date
- 1984-01-02~/*
beginning approximately 1984-01-02; end date unknown

- 1984~/2004-06
beginning approximately 1984 and ending June 2004
- 1984/2004-06~
beginning 1984 and ending approximately June 2004
- 1984?/2004%
beginning is uncertain but thought to be 1984; end is uncertain but thought to be approximately 2004

4.5.2 Level 2

The Level 2 enhanced time interval feature extends Level 1:

- Portions of a date may be designated as approximate, uncertain, or unspecified.
- The start date may be tagged as "before or" that date, and the end date "or after".

Examples:

- 2004-06~01/2004-06~20
A time interval in June 2004 beginning approximately the first and ending approximately the 20th.
- 2004-06-XX/2004-07-03
The time interval began on an unspecified day in June 2004 and ended July 3.
- ..2004-06-01/~2004-06-20
A time interval beginning before or on 1 June 2004 and ending approximately the 20th
- 2004-06-01~/2004-06-20..
A time interval beginning before approximately 1 June 2004 and the 20th or later.

4.6 Year exceeding four digits

Part 1 of this standard allows a year to exceed four digits (a year after 9999 or before -9999) however it requires mutual agreement of the partners in the information exchange.

Presented here is an alternative method, which does not require mutual consent. It may be used only for dates where only the year is significant, not the month or day.

4.6.1 Level 1

'Y' may be used at the beginning of the date string to signify that the date is a year, when (and only when) the year exceeds four digits, i.e. for years later than 9999 or earlier than -9999.

Format: "Y"YYYY..... Example: Y170000002 (*the year 170000002*)
"Y-YYYY..... Example: Y-170000002 (*the year -170000002*)

4.6.2 Level 2 (needs reconsideration)

Level 2 presents an alternative, exponential form. 'E' is used to mean "times 10 to the power of" thus 17E8 means "17 times (10 to the eighth power)", or 170000000000. (And as in level 1.'Y' at the beginning of the string indicates "year".)

Examples

- y17E7
the year 170000000
- y-17E7
the year -170000000

4.7 Significant digits

When a year is followed by 'S', followed by a positive integer, the integer indicates the number of significant digits for the expressed year.

4.7.1 Level 1

This feature is not used in level 1.

4.7.2 Level 2

For level 2 this feature may be used for any of the following three ways to express a year:

- Four-digit year
- Year longer than four digits expressed as an integer.
- Year expressed in exponential form.

Examples

- *1950S2*
Some year between 1900 and 1999, estimated to be 1950.
- *Y171010000S3*
Some year between 171000000 and 171999999, estimated to be 171010000.
- *Y17101E4S3*
Same meaning as previous example.

4.8 Divisions of a year

For a year-and-month expression (e.g. 1984-04) the month component may take on values of 21 or above (in place of a month value, 01 through 12). These values signify a division of a year (e.g. "the season Spring").

4.8.1 Level 1

The values 21, 22, 23, 24 may be used to signify 'Spring', 'Summer', 'Autumn', 'Winter', respectively.

Format: YYYY-SS Example: 2001-21 (*Spring, 2001*)

4.8.2 Level 2

Values greater than 24 may be used.

This specification provides an initial set of values, and there will be a registration mechanism for additional values.

The initial sets of values for traditional division of a year are:

- 21-24 = Spring, Summer, Autumn, Winter, independent of "Hemisphere"
- 25-28 = Spring - Northern Hemisphere, Summer- Northern Hemisphere, Autumn - Northern Hemisphere, Winter - Northern Hemisphere
- 29-32 = Spring - Southern Hemisphere, Summer- Southern Hemisphere, Autumn - Southern Hemisphere, Winter - Southern Hemisphere
- 33-36 = Quarter 1, Quarter 2, Quarter 3, Quarter 4 (3 months each)
- 37-39 = Quadrimester 1, Quadrimester 2, Quadrimester 3 (4 months each)

40-41 = Semestral 1, Semestral-2 (6 months each)

4.9 One of a set

Square brackets enclosing a list of dates are used to mean "one of these dates". This feature may be used for example to express "Year of Publication", when it is known that the year is one of a set of years, for example 1984, 1986, or 1988.

4.9.1 Level 1

This feature is not used for level 1.

4.9.2 Level 2

For level 2 double-dot notation may be used. double-dot indicates all the values between the two values it separates, inclusive. Double-dot at the beginning or end of the list means "on or before" or "on or after" respectively; see the second, third, and fourth example below. Different elements of a list may have different precisions, as in the fifth example.

Examples

- [1667, 1668, 1670..1672]
One of the years 1667, 1668, 1670, 1671, 1672
- [..1760-12-03]
December 3, 1760; or some earlier date
- [1760-12..]
December 1760, or some later month
- [1760-01, 1760-02, 1760-12..]
January or February of 1760 or December 1760 or some later month
- [1667, 1760-12]
Either the year 1667 or the month December of 1760.

4.10 Multiple dates

Curly braces may be used to wrap an inclusive list (all members included).

For example {1960,1961,1962,1963} might be used to indicate the years of publication of a book - it was published in each of 1960, 1961, 1962, and 1963. Different elements of a list may have different precisions, as in the second example.

4.10.1 Level 1

This feature is not used in level 1.

4.10.2 Level 2

Examples

- {1667,1668,1670..1672}
All of the years 1667, 1668, 1670, 1671, 1672
- {1960, 1961-12}
The year 1960 and the month December of 1961.

4.11 Decade

A string consisting of three digits represents a decade, for example “the 1960s”. It is the ten-year time interval of those years where the three specified digits are the first three digits of the year.

Representation of a decade must be exactly three digits, leading zeros, if any, must be included. Thus the time interval 200 through 209 is represented as ‘020’ and NOT ‘20’; the latter would represent the time interval 2000 through 2099. Furthermore, ‘196’ is not to be confused with the year 196, that would be represented as ‘0196’.

4.11.1 Level 1

This feature is not used for level 1.

4.11.2 Level 2

Format: YYY

Example: 196 (1960-1969)

Example: 196~ (approximate decade)

Note: as a decade expresses decade precision, in the second example, “approximate decade” means for example “the decade is approximated to be the 1960s, but it might be the 1950s or 1970s.” It does NOT mean the time interval beginning approximately at the beginning of and ending approximately at the end of the 1960s. The latter would be expressed as 1960~/1970~ and would have year precision.

5 Repeat rules for recurring time intervals

This section extends ISO 8601-1:2016, 4.5 “Recurring Time Interval”, by adding a rule part that defines the repeat pattern to the end of the recurring time interval structure.

All features in this section are defined at level 1 for the purpose of profiles, which may refer to the levels when specifying conformance to the profile. (Profiles are described in Annex B.)

The section is based on the [RFC 5545:2009] “Internet Calendaring and Scheduling Core Object Specification (iCalendar), Section 3.3.10, Recurrence Rule” to ensure easy migration and transition between the two standards.

5.1 Means of specifying repeat rules

Repeat rules for recurring time intervals shall be expressed in one of the following ways.

- a) By a number of recurrences (optional), a start and end of the time interval, and repeat rule. If the number of recurrences is absent, the number of occurrences is unbounded.
- b) By a number of recurrences (optional), a duration and repeat rule. If the number of recurrences is absent, the number of occurrences is unbounded.
- c) By a number of recurrences (optional), a start and duration of the time interval, and repeat rule. If the number of recurrences is absent, the number of occurrences is unbounded.
- d) By a number of recurrences (optional), a duration and end of the time interval, and repeat rule. If the number of recurrences is absent, the number of occurrences is unbounded.

5.2 Separators and designators

Repeat rules for a recurring time interval is expressed according to the following structure.

All representations start with the designator [R], followed, without spaces, by the number of recurrences, if present, followed, without spaces, by a solidus [/], followed, without spaces, by the expression of a time interval as per ISO 8601-1:2016, 4.4.1, without spaces, by a solidus [/], followed, without spaces, followed by the repeat rule as per 5.3. For the representations 5.1 a), 5.1 b), 5.1 c) and 5.1 d) the time intervals as per ISO 8601-1:2016, 4.4.1 a), 4.4.1 b), 4.4.1 c) and 4.4.1 d) shall be used, respectively.

5.3 Repeat rules

A repeat rule [RRULE] shall be expressed as a structured component consisting of a list of one or more repeat rule parts. Each rule part is defined by a **name=value** pair. The rule parts are separated from each other by the **semicolon** [;] character. The rule parts are not ordered in any particular sequence. Individual rule parts must only be specified once.

5.4 Frequency rule part

The “Frequency” [FREQ] rule part identifies the type of recurrence rule. This rule part MUST be specified in the repeat rule unless the “Divisional” [DIVI] is present, only one of the two can be used. Valid values include *SECONDLY* [SE], to specify recurring time intervals based on a time interval of a second or more; *MINUTELY* [MI], to specify recurring time intervals based on a time interval of a minute or more; *HOURLY* [HR], to specify recurring time intervals based on a time interval of an hour or more; *DAILY* [DY], to specify recurring time intervals based on a time interval of a day or more; *WEEKLY* [WE], to specify recurring time intervals based on a time interval of a week or more; *MONTHLY* [MO], to specify recurring time intervals based on a time interval of a month or more; and *YEARLY* [YR], to specify recurring time intervals based on a time interval of a year or more.

5.5 Divisional rule part

The “Divisional” [DIVI] rule part identifies the type of recurrence rule. This rule part MUST be specified in the repeat rule unless the “Frequency” [FREQ] is present, only one of the two can be used. Valid “Division of a year” values are defined in section 4.8.2.

5.6 Time interval rule part

The “Time interval” [INTR] rule part contains a positive integer representing at which time intervals the “Frequency” or “Divisional” rule part repeats. The default value rule is “1”, meaning every second for a *SECONDLY* rule, every minute for a *MINUTELY* rule, every hour for an *HOURLY* rule, every day for a *DAILY* rule, every week for a *WEEKLY* rule, every month for a *MONTHLY* rule, every year for a *YEARLY* rule, and a single repeat for each *DIVISIONAL* rule.

For example, used with the *FREQUENCY* rule value of *DAILY* rule, a value of “8” means every eight days:

FREQ=DAILY;INTR=8

Used with a *DIVISIONAL* rule value of *SUMMER*, a value of “2” means every second summer:

DIVI=22;INTR=2

5.7 By rule parts

“By rule parts” [BYXX] modifies the repeats in some manner. **By rule parts** for a time interval of the same length or longer than the frequency generally reduces or limits the number of occurrences of the repeats generated.

Example:

FREQ=DA;BYMO=1 reduces the number of repeat instances from all days (if **By Month** rule part is not present) to all days in January.

By rule parts for a time interval shorter than the frequency generally increases or expands the number of occurrences of the repeats.

Example:

FREQ=YE;BYMO=1,2 increases the number of days within the yearly repeat set from 1 (if **By Month** rule part is not present) to 2.

5.7.1 By second rule part

The “By Second” [BYSE] rule part specifies a comma-separated list of seconds within a minute. Valid values are 0 to 59.

5.7.2 By minute rule part

The “By Minute” [BYMI] rule part specifies a comma-separated list of minutes within an hour. Valid values are 0 to 59.

5.7.3 By hour rule part

The “By Hour” [BYHR] rule part specifies a comma-separated list of hours of the day. Valid values are 0 to 23.

5.7.4 By day rule part

The “By Day” [BYDY] rule part specifies a comma-separated list of days of the week; **MO** indicates Monday; **TU** indicates Tuesday; **WE** indicates Wednesday; **TH** indicates Thursday; **FR** indicates Friday; **SA** indicates Saturday; and **SU** indicates Sunday.

Each **By Day** value can also be preceded by a positive (+n) or negative (-n) integer. If present, this indicates the nth occurrence of a specific day within the *MONTHLY* or *YEARLY* “**RRULE**”.

For example, within a *MONTHLY* rule, +1MO (or simply 1MO) represents the first Monday within the month, whereas -1MO represents the last Monday of the month. The numeric value in a **By Day** rule part with the *FREQ* rule part set to *YEARLY* corresponds to an offset within the month when the **By Month** rule part is present, and corresponds to an offset within the year when the **By Week No** or **By Month** rule parts are present. If an integer modifier is not present, it means all days of this type within the specified frequency. For example, within a *MONTHLY* rule, MO represents all Mondays within the month. The **By Day** rule part MUST NOT be specified with a numeric value when the *FREQ* rule part is not set to *MONTHLY* or *YEARLY*. Furthermore, the **By Day** rule part MUST NOT be specified with a numeric value with the *FREQ* rule part set to *YEARLY* when the **By Week No** rule part is specified.

5.7.5 By month day rule part

The “By Month Day” **[BYMD]** rule part specifies a comma-separated list of days of the month. Valid values are 1 to 31 or -31 to -1. For example, -10 represents the tenth to the last day of the month. The **By Month Day** rule part MUST NOT be specified when the *FREQ* rule part is set to *WEEKLY*.

5.7.6 By year day rule part

The “By Year Day” **[BYYD]** rule part specifies a comma-separated list of days of the year. Valid values are 1 to 366 or -366 to -1. For example, -1 represents the last day of the year (December 31st) and -306 represents the 306th to the last day of the year (March 1st). The **By Year Day** rule part MUST NOT be specified when the *FREQ* rule part is set to *DAILY*, *WEEKLY*, or *MONTHLY*.

5.7.7 By week no rule part

The “By Week No” **[BYWN]** rule part specifies a comma-separated list of ordinals specifying weeks of the year. Valid values are 1 to 53 or -53 to -1. This corresponds to weeks according to week numbering as defined in ISO 8601-1:2016. A week is defined as a seven-day time interval, starting with a Monday. Week number one of the calendar year is the first week that contains at least four (4) days in that calendar year. This rule part MUST NOT be used when the *FREQ* rule part is set to anything other than *YEARLY*. For example, 3 represents the third week of the year.

Note: Week 53 can only occur when Thursday is January 1 or if it is a leap year and Wednesday is January 1.

5.7.8 By month rule part

The “By Month” **[BYMO]** rule part specifies a comma-separated list of months of the year. Valid values are 1 to 12.

5.7.9 Multiple “By rule” parts

If multiple **By rule parts** are specified, then after evaluating the specified **Frequency** and **Time interval** rule parts, the **By rule parts** are applied to the current set of evaluated occurrences in the following order: **By Month**, **By Week No**, **By Year Day**, **By Month Day**, **By Day**, **By Hour**, **By Minute** and **By Second**; then **number of recurrences** and **duration** are evaluated.

5.7.10 Example of evaluating multiple By xxx rule parts

R/20150104T083000/PM15S00/FREQ=YR;INTR=2;BYMO=1;BYDA=SU;BYHO=8,9;BYMIN=30

First, the “INTR=2” would be applied to “FREQ=YR” and be evaluated as “every other year”. Then, “BYMO=1” would be evaluated as “every January, every other year”. Then, “BYDA=SU” would be evaluated as “every Sunday in January, every other year”. Then, “BYHO=8,9” would be evaluated as “every Sunday in January at 8 AM and 9 AM, every other year”. Then, “BYMI=30” would be evaluated as “every Sunday in January at 8:30 AM and 9:30 AM, every other year”. Then, lacking information from “RRULE”, the second is derived from “Time interval Start” value, to end up in “every Sunday in January at 8:30:00 AM and 9:30:00 AM, every other year”. Similarly, if the By Minute, By Hour, By Day, By Month Day, or By Month rule part is missing, the appropriate minute, hour, day, or month will be retrieved from the “Time interval Start” value. Finally, the time interval duration is defined by the “Duration” value, which in this case is 15 minutes.

5.8 Complete representations

When the application identifies the need for a complete representation of a recurring time interval with repeat rules, it shall use an expression in accordance with 5.2, combining any complete recurring time interval representation as defined in ISO 8601-1:2016, 4.5.3 with the repeat rule.

Basic format: R_n/YYYYMMDDThhmmss/YYYYMMDDThhmmss/FREQ=value;INTR=n
 R_n/YYYYMMDDThhmmss/PnnYnnMnnDTnnHnnMnnS/FREQ=value;INTR=n
 R_nPnnYnnMnnDTnnHnnMnnS/YYYYMMDDThhmmss/FREQ=value;INTR=n
 R_n/PnnYnnMnnDTnnHnnMnnS/FREQ=value;INTR=n

Example: R12/20150929T140000/20150929T153000/FREQ=WE;INTR=2
 R12/20150929T140000/P1H30M0S/ FREQ=WE;INTR=2
 R12/P2H30M0S/ 20150929T153000/ FREQ=WE;INTR=2
 R12/P2Y10M15DT10H30M20S/FREQ=WE;INTR=2

Extended format: R_n/YYYY-MM-DDThh:mm:ss/YYYY-MM-DDThh:mm:ss/FREQ=value;INTR=n
 R_n/YYYY-MM-DDThh:mm:ss/PnYnMnDTnHnMnS/FREQ=value;INTR=n
 R_n/PnnYnnMnnDTnnHnnMnnS/YYYY-MM-DDThh:mm:ss/FREQ=value;INTR=n

Example: R12/2015-09-29T14:00:00/2015-09-29T15:30:00/FREQ=WE;IINTR=2
 R12/2015-09-29T14:00:00/P1H30M0S/FREQ=WE;INTR=2
 R12/P1H30M0S/ 2015-09-29T15:30:00/FREQ=WE;INTR=2

5.9 Representations other than complete

A representation other than complete of a recurring time interval with repeat rule shall be an expression in accordance with 5.1 and 5.2, where the time interval is represented in accordance with ISO 8601-1:2016, 4.4.5.

Annex A (normative)

EBNF notation

The syntax used in this EBNF description is ISO/IEC 14977:1996

```

Rule:           name = ... ;
Terminal:      '...' or "..."
Non Terminal: ...
Concatination: ,
Choice:        |
Optional:      [...]
Repetition (0 or more): {...}
Repetition (1 or more): {...}-
Repetition (n times):  n * ...
Grouping:      (...)
Exception:    ...-...
Special sequence: ?...?
Comment:       (*...*)

(* Base definitions *)

year = positiveYear | negativeYear | "0000" ;

positiveYear = positiveDigit, digit, digit, digit
  | "0", positiveDigit, digit, digit
  | "00", positiveDigit, digit
  | "000", positiveDigit ;

negativeYear = "-", positiveYear ;

monthDay = ("01" | "03" | "05" | "07" | "08" | "10" | "12"), "-", OneThru31
  | ("04" | "06" | "09" | "11"), "-", OneThru30
  | "02-", OneThru29 ;

yearMonth = year "-" month ;

month = oneThru12 ;

day = oneThru31 ;

date = year | yearMonth | yearMonthDay ;

oneThru12 = ("0", positiveDigit) | "10" | "11" | "12" ;

oneThru29 = ("0", positiveDigit) | (("1" | "2"), digit) ;

oneThru30 = OneThru29 | "30" ;

oneThru31 = OneThru30 | "31" ;

digit = positiveDigit | "0" ;

positiveDigit = "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9" ;

```

```

(* 4. Date and Time Extensions *)

(* 4.1.1 Extended Format *)

yearMonthDay = year, "-", monthDay ;

(* 4.1.1 Levels *)

(* For the extension features, two levels are defined: level 1 *)
(* and level 2. Each major subsection of section 4 covers a *)
(* general feature; some functions covered by that feature are *)
(* level 1 and some are level 2. These levels are defined for *)
(* the purpose of profiles, which may refer to the levels when *)
(* specifying conformance to the profile. *)

(* 4.2.1 Level 1 - Uncertain and/or Approximate Date *)

uaDate = yearMonthDay, uaSymbol ;

uaSymbol = "?" | "~" | "%" ;

(* Reduced accuracy *)

reducedDate = (year | yearMonth), uaSymbol ;

(* 4.2.2 Level 2 - Uncertain and/or Approximate Date *)

qualifiedDate = [uaSymbol], year, [uaSymbol], "-",
                 [uaSymbol], month, [uaSymbol], "-",
                 [uaSymbol], day, [uaSymbol] ;

(* 4.3.1 Level 1 - Unspecified Date *)

unspecifiedDate = (yearMonth, "-XX") | (year, "-XX-XX") | "XXXX-XX-XX" ;

(* Reduced accuracy *)

reduceAccuracyDate = (2 * digit, "XX")
                     | (3 * digit, "X")
                     | ("XXXX", ["-XX"])
                     | (year, "-XX") ;

(* 4.3.2 Level 2 - Unspecified Date *)

replacementDate = 4 * (digit | "X"),
                  [ "-", 2 * (digit | "X"),
                  [ "-", 2 * (digit | "X")]] ;

(* 4.4.1 Level 1 - Before or After *)

(* This feature is not used in level 1. *)

(* 4.4.2 Level 2 - Before or After *)

beforeAfterDate = ("..", year, ["-", month, ["-", day]])
                  | (year, ["-", month, ["-", day]], "..") ;

(* 4.5.1 Level 1 - Enhanced Interval *)

```

```
startEndOpenOrUnknown = [yearMonthDay], ["*"], "/", ["*"], [yearMonthDay] ;

L1Interval = [year | yearMonth | yearMonthDay], [uaSymbol | "*"],
    "/", ["*"], [year | yearMonth | yearMonthDay], [uaSymbol] ;

(* 4.5.2 Level 2 - Enhanced Interval *)

L2Interval = [".."], (qualifiedDate | unspecifiedDate | replacementDate),
    "/", (qualifiedDate | unspecifiedDate | replacementDate ), [...] ;

(* 4.6.1 Level 1 - Year Exceeding Four Digits *)

longYear = "Y", ["-"], positiveDigit 4 * digit, {digit} ;

(* 4.6.2 Level 2 - Year Exceeding Four Digits *)

longYearScientific = "y", ["-"], positiveDigit, digit, "e" {digit}- ;

(* 4.7.1 Level 1 - Significant Digits *)

(* This feature is not used in level 1. *)

(* 4.7.2 Level 2 - Significant Digits *)

yearDate = (year | longYear | longYearScientific), "S", positiveDigit, {digit} ;

(* 4.8.1 Level 1 Divisions of a year *)

divisionL1 = year, divisionSet1;

divisionSet1 = ("21" | "22" | "23" | "24") ;

(* 4.8.2 Level 2 Divisions of a year *)

divisionL2 = year, divisionSet2 ;

divisionSet2 = ((("2" | "3"), digit) | "40" | "41" ;

(* 4.9.1 Level 1 - One of a Set  *)

(* This feature is not used in level 1. *)

(* 4.9.2 Level 2 - One of a Set  *)

choiceList = "[", listContent "]" ;

listContent = earlier, {",", listElement}
    | [earlier, ","], {listElement, ","}, later
    | listElement {",", listElement}-
    | consecutives ;

listElement = date | qualifiedDate | unspecifiedDate | consecutives ;

earlier = "...", date ;

later = date "..." ;

consecutives = yearMonthDay, "...", yearMonthDay
```

```

    | yearMonth, "..", yearMonth
    | year, "..", year ;

(* 4.10.1 Level 1 - Multiple Dates *)

(* This feature is not used in level 1. *)

(* 4.10.2 Level 2 - Multiple Dates *)

inclusiveList = "{" listContent "}" ;

(* 4.11.1 Level 1 - Decade *)

(* This feature is not used in level 1. *)

(* 4.11.2 Level 2 - Decade *)

decade = 3 * digit, ["~"] ;

(* 5. Repeat Rules for Recurring Time Intervals *)

(* All features in this section are defined at level 1 for the *)
(* purpose of profiles, which may refer to the levels when      *)
(* specifying conformance to the profile.                      *)

recurringIntervalWithRules = recurringInterval, "/", recurringRule ;

recurringInterval = 'R', {integer}, '/', interval ;

interval = intervalExplicit | intervalStart | intervalEnd | duration ;

intervalExplicit = dateAndTime, '/', dateAndTime ;

intervalStart = dateAndTime, '/', duration ;

intervalEnd = duration, '/', dateAndTime ;

duration = 'P', (durationTime | durationDate | durationWeek) ;

durationDate = durationDay, [durationTime] ;

durationTime = 'T', (durationHour | durationMinute | durationSecond) ;

durationHour = hour, 'H', [durationMinute] ;

durationMinute = minute, 'M', [durationSecond] ;

durationSecond = second, 'S' ;

durationDay = day, 'D' ;

durationWeek = week, 'W' ;

recurringRule = recurringRulePart, {';', recurringRulePart} ;

recurringRulePart = ( ('FREQ', '=', frequency) | ('DIVI', '=', division))
    | ( 'INTR', '=', digit {digit} )
    | ( 'BYSE', '=', second )

```

```
| ( 'BYMI', '=', minute )
| ( 'BYHR', '=', hour )
| ( 'BYDY', '=', byWeekDayList )
| ( 'BYMD', '=', byMonthDayList )
| ( 'BYYD', '=', byYearDayList )
| ( 'BYWN', '=', byweekNumberberList )
| ( 'BYMO', '=', byMonthList ) ;

frequency = 'SE' | 'MI' | 'HR' | 'DY' | 'WE' | 'MO' | 'YR' ;

division = divisionSet2 ;      (* see 4.8.2 *)

byWeekDayList = weekDayNumber, {',', weekDayNumber} ;

weekDayNumber = [weekByNumber], weekDay ;

weekDay = 'SU' | 'MO' | 'TU' | 'WE' | 'TH' | 'FR' | 'SA' ;

byMonthDayList = monthDayNumber, {',', monthDayNumber} ;

monthDayNumber = ["+" | "-"], monthDay ;

byYearDayList = yearDayNumber, {',', yearDayNumber} ;

yearDayNumber = ["+" | "-"], yearDay ;

byweekNumberList = weekNumber, {',', weekNumber} ;

weekByNumber = ["+" | "-"], weekNumber ;

byMonthList = monthNumber, {',', monthNumber} ;
```

Annex B (normative)

ISO 8601 profiles

B.1 Statement of the problem

ISO 8601 includes many features, and, in many cases, several different formats to represent a single feature. Two vendors implementing 8601 may implement different features, or different representations of a given feature, and their products might not interoperate. Moreover, some features have more than one interpretation and different vendors might select different interpretation, making interoperability even less likely. 8601 does not provide guidelines to address these concerns, levels of support, or conformance requirements. Each vendor is left to decide for itself what features, representation, and interpretations to implement.

B.1.1 Some historical background

The W3C defined date and time formats to begin to address these concerns: <http://www.w3.org/TR/xmlschema-2/#isoformats>. These formats are based on 8601, and they have proved invaluable for the interoperability of Web data. These formats have their roots in what we call a “profile” of ISO 8601: Date and Time Formats. <http://www.w3.org/TR/NOTE-datetime> which states

“This document defines a profile of ISO 8601, the International Standard for the representation of dates and times. ISO 8601 describes a large number of date/time formats. To reduce the scope for error and the complexity of software, it is useful to restrict the supported formats to a small number. This profile defines a few date/time formats, likely to satisfy most requirements.”

The W3C Note, submitted in 1997 by Reuters, was never endorsed by the W3C, but it did provide the original impetus for the development of the very useful and successful W3C date and time formats.

B.1.2 Generalizing the concept of an ISO 8601 profile

This document attempts to expand and generalize the concept of an ISO 8601 Profile.

A Profile of ISO 8601 is a specification developed by a particular community which explains how ISO 8601 is to be used, to carry out a particular function or group of functions relevant to that community.

1. It may list features of 8601 to be supported.
2. In cases where there are multiple methods specified in 8601 to support a particular function, the profile may select a single method.
3. In cases where there are different interpretations of a particular function, the profile may select a single interpretation, or provide clarification.
4. It might list features that are not relevant and need not be supported.
5. It might specify several levels of support.

At minimum, a profile should state what an implementer must implement in order to claim conformance to the profile. If there are multiple levels specified, it should state conformance requirements for each level.

Different communities may define different profiles. In fact any given community may define multiple profiles. “Community” is used loosely to mean a group with a common interest in 8601. It is not intended that 8601 profiles be approved by any formal body; any person or community can develop a profile. There should however be a unique name for every profile so that it may be referenced. The registration agency for ISO 8601 should register profiles upon request, and help to assure uniqueness of names. It is hoped that there will be mechanisms developed to provide interoperability between profiles however that is beyond the scope of this document.

This document provides one (draft) profile (section 2), and it is expected that additional profiles will be developed.

B.1.3 Multiple profiles

A product may implement several profiles. Here we distinguish between static support and dynamic operation.

B.1.3.1 Static Support

Suppose profile X specifies features A, B, and C, and excludes feature D. If a product claims to support profile X that does not mean that it cannot support feature D. A different profile – profile Y – might specify features C, D, and E. And there is not, nor should there be, anything inherent in the profile concept that would preclude a product from supporting as many profiles as it chooses to support.

B.1.3.2 Dynamic Operation

On the other hand suppose there are two communication parties, P1 and P2, exchanging ISO 8601 data. P1 uses a product that supports profile X (only) while P2 uses a product that supports profiles X and Y. In order for P1 and P2 to interoperate they must operate under profile X, because it is the only profile in common supported. (Thus P2 must be able to suppress features excluded by P1.)

The process by which two communicating parties agree to operate according to a particular profile is a complex area which needs further study. It is not fully addressed by this document and is to a certain extend outside the scope of this document. Three possible approaches:

- 1) **Specified by Protocol.** The exchange of ISO 8601 data might be done under the control of a protocol, which could be used to negotiate a particular profile. (8601 itself is a data format, not a protocol, and could not be adapted to accomplish this task.)
- 2) **Specified by Format.** Two parties might be exchanging data of a certain type, for example bibliographic data. The definition of the bibliographic format could specify that date/time data conform to a specific profile.
- 3) **Specified by datatype.** For exchange of date serialized into XML, or RDF (any RDF serialization), date and time data can carry its datatype, for example xs:date, which, as noted above, corresponds to the W3C profile.

Annex C (informative)

The Extended Date/Time Format - A Profile of ISO 8601 (Parts 1 and 2)

C.1 Introduction

The Extended Date/Time Format (EDTF) profile of ISO 8601 was developed by the bibliographic community along with the participation of communities with related interests.

This profile specifies three levels: level 0, level 1, and level 2. Level 0 specifies features of ISO 8601 Part 1. Levels 1 and 2 specify features of Part 2/level 1 and Part2 /level 2 respectively.

C.1.1 Compliance

An implementation of this specification must support all of the features listed for Level 0, and the vendor should state one of the following:

- Level 0 (only) is supported.
- Level 0 is supported and in addition the following features of levels 1 and 2 are supported (list features).
- Level 1 is supported.
- Level 1 is supported and in addition the following features of level 2 are supported (list features).
- Level 2 is supported.

Two communication parties that agree to operate according to this profile must suppress, during their communication, any ISO 8601 features that are not included in level 0.

C.1.2 Extended format

All features in this profile use extended format: hyphens separating date components and colons separating time components. Basic format is not used.

C.1.3 Level 0

In order to claim support for level 0 of this profile, an implementation must support date (year only, year and month, and year, month and day), date and time, time interval, and century, as specified in 2.3.1-2.3.3

C.1.3.1 Date

A date string represents one of the following:

- year, month, and day (e.g. 2001-02-03)
- year and month (e.g. 2008-12)
- year (e.g. 2008)

Year must be four digits. (Years longer than four digits are covered in levels 1 and 2.)

A year may be positive, negative, or year zero. (This specification assumes astronomical numbering, which includes the year zero.)

C.1.3.2 Date and Time

A date/time string is composed according to one of three representations as illustrated in the following three examples:

- 2001-02-03T09:30:01
- 2004-01-01T10:10:10Z
- 2004-01-01T10:10:10+05:00

Zone-offset may be omitted or included. Time zone designation consists of either a 'Z' to indicate UTC, or a '+' or '-' to indicate "ahead of UTC" or "behind UTC", followed by a 2-digit hour, followed optionally by a colon and the 2-digit minutes.

C.1.3.3 Time interval

A time interval, as represented by a start date and an end date (separated by a forward slash), is a time interval beginning sometime during the start date and ending sometime during the end date. The actual instants at which the time interval begins or ends can be narrowed down only to the precision of the start or end date. The start and end dates are both as prescribed in 2.3.1. Either endpoint may be a year, year-month, or year-month-day. The end endpoint must be later than or equal to the start endpoint.

Examples

- 1964/2008
A time interval with year precision, beginning sometime in 1964 and ending sometime in 2008.
- 2004-06/2006-08
A time interval with month precision, beginning sometime in June 2004 and ending sometime in August of 2006.
- 2004-02-01/2005-02-08
A time interval with day precision, beginning sometime on February 1, 2004 and ending sometime on February 8, 2005.
- 2004-02-01/2005-02
A time interval beginning sometime on February 1, 2004 and ending sometime in February 2005. Note that the start endpoint has different precision than the end endpoint (day/month) and therefore the precision of the time interval at large is undefined.
- 2004-02-01/2005
A time interval beginning sometime on February 1, 2004 and ending sometime in 2005. The start endpoint has day precision and the end endpoint has year precision. Similar to the previous example, the precision of the time interval at large is undefined.
- 2005/2006-02
A time interval beginning sometime in 2005 and ending sometime in February 2006.

A time interval represents one of the following, depending on the application:

- a) The period of time represented by the time interval;
- b) A specific date during that time interval, when an event occurred.

So for example, the time interval '1956/1967', depending on the application, means either

- a) The time interval beginning sometime in 1956 and ending sometime in 1967; or

b) The event in question occurred during one of the years 1956, 1957, ..., 1967 and in this case, has year precision.

In a similar sense, the time interval '1956-01/1967-06' has month precision, and '1956-01-15/1967-06-20' has day precision.

C.1.3.4 Century

Two digits may be used to indicate the century which is the hundred year time interval consisting of years beginning with those two digits.

For example '19' may be used to indicate the time interval represented by '1900/1999'.

Note: For purposes of this profile, a "century" is a 100-year time interval. For example, '1866/1965' is a century. '1900/1999' and '1901/2000' are also centuries, and although the latter is sometimes referred to as the "18th century", this specification DOES NOT address named centuries such as the "18th century" nor does it take a position on the meaning of a named century. The profile addresses centuries of the form nn00/nn99 only, where 'nn' is any two-digit number, for example '1900/1999'.

C.1.4 Level 1

Level 1 of this profile requires support for:

- Level 0, and
- all of the features of Level 1 of ISO 8601 Part 2, with the exception of recurring time intervals (section 5).

C.1.5 Level 2

Level 2 of this profile requires support for:

- Level 1, (with the exception of recurring time intervals, section 5) and
- all of the features of Level 2 of ISO 8601 Part 2.

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